

What is claimed is:

1. A lithium secondary battery comprising:
an internal electrode body formed by winding a positive electrode and a negative electrode on an outer periphery wall
5 of a hollow cylindrical winding core and dipped into nonaqueous electrolyte solution;
a cylindrical battery case containing the internal electrode body inside with both ends thereof being open; and
electrode caps having battery caps, internal terminals,
10 and external terminals which seal said internal electrode body at the both open ends of the battery case,
wherein at least one of the electrode caps has a pressure release hole in a position corresponding with the center axis of the winding core.
- 15 2. The lithium secondary battery according to claim 1, wherein a center axis of said winding core overlaps the center axis of said battery case.
3. The lithium secondary battery according to claim 1, wherein said external terminals are made to comprise a center
20 hollow portion so that this center hollow portion functions as a pressure release path of said pressure release hole.
4. The lithium secondary battery according to claim 1, wherein the capacity (C) of said internal electrode body is

not less than 2 Ah, and said pressure release hole's sectional area (S_1) as well as said winding core's center hollow portion's sectional area (S_2) are larger than $0.3 \text{ (cm}^2\text{)}$.

5 5. The lithium secondary battery according to claim 4,
wherein said winding core has thickness of not less than 0.8 mm.

10 6. The lithium secondary battery according to claim 4,
wherein the values given by dividing said pressure release hole's sectional area (S_1) and said winding core's center hollow portion's sectional area (S_2) by said internal electrode body's battery capacity (C) respectively (S_1/C and S_2/C) are both larger than $0.02 \text{ (cm}^2\text{/Ah)}$.

15 7. The lithium secondary battery according to claim 4,
wherein the size of said winding core's center hollow portion's sectional area (S_2) is not less than said pressure release hole's sectional area (S_1).

8. The lithium secondary battery according to claim 1,
wherein said winding core is made of aluminum or an aluminum alloy.

20 9. A lithium secondary battery comprising:
 an internal electrode formed by winding a positive electrode and a negative electrode on an outer periphery wall

of a hollow cylindrical winding core and dipped into nonaqueous electrolyte solution;

a cylindrical battery case containing the internal electrode body inside with both ends thereof being open; and

5 electrode caps at least one of which has a pressure release hole and which seal said internal electrode body at the both open ends of the battery case,

wherein a pressure release valve is disposed on the internal periphery wall of or at the end of said pressure
10 release hole with the elastic body and the metal foil being brought into pressure contact with a spacer to seal said battery case.

10. The lithium secondary battery according to claim 9,
wherein said metal foil is formed so as to have the surface
15 pressure of not less than 980 kPa.

11. The lithium secondary battery according to claim 9,
wherein said spacer is formed with a metal material having
a Young's modulus not less than 170 Gpa.

12. The lithium secondary battery according to claim 9,
20 wherein said spacer is a ring member or a ring member having stopper structure in order that the stress not less than a constant amount will not be applied to said elastic body.

13. The lithium secondary battery according to claim 9, wherein said metal foil is made of Al, Cu, Ni, or alloys containing them respectively that is coated by the fluoride resin.

5 14. The lithium secondary battery according to claim 9, wherein the stress applied to said elastic body is not less than 980 kPa and not more than the force amount to cause that elastic body to maintain elasticity maintenance percentage of not less than 95%.

10 15. The lithium secondary battery according to claim 9, wherein said elastic body is packing processed in advance to a predetermined size.

15 16. The lithium secondary battery according to claim 15, wherein said packing is made of ethylene propylene rubber, polyethylene, polypropylene or fluoride resin.

17. The lithium secondary battery according to claim 9, wherein said electrode cap comprises said pressure release hole in a position corresponding with said winding core's center axis.

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18. The lithium secondary battery according to claim 1, wherein said pressure release hole is commonly used as the electrolyte solution inlet.

19. A lithium secondary battery comprising:

an internal electrode formed by winding a positive electrode and a negative electrode on an outer periphery wall of a hollow cylindrical winding core and dipped into
5 nonaqueous electrolyte solution;

a cylindrical battery case containing the internal electrode body inside with both ends thereof being open; and electrode caps which seal said internal electrode body at the both open ends of the battery case, wherein:

10 said electrode caps are formed in approximately rotary symmetry around the center axis of said battery case being a center.

20. The lithium secondary battery according to claim 1, which has a battery capacity of not less than 2 Ah.

15 21. The lithium secondary battery according to claim 9, which has a battery capacity of not less than 2 Ah.

22. The lithium secondary battery according to claim 1, which is a battery to be mounted on vehicles.

20 23. The lithium secondary battery according to claim 9, which is a battery to be mounted on vehicles.

24. The lithium secondary battery according to claim 22, which is for an engine starter.

25. The lithium secondary battery according to claim 23, which is for an engine starter.

26. The lithium secondary battery according to claim 22, which is used in an electric vehicle or a hybrid electric
5 vehicle.

27. The lithium secondary battery according to claim 23, which is used in an electric vehicle or a hybrid electric vehicle.

28. A method of manufacturing a lithium secondary battery,
10 which comprises:

preparing a plate-like member functioning as a cap after production, an elastic body, a metal foil and a spacer which are processed in advance to a predetermined size;

disposing said elastic body and said metal foil in a
15 predetermined position;

combining them with said spacer to form a pressure release hole unit;

fitting said pressure release hole unit into said plate-like member to produce electrode caps;

20 containing an internal electrode body in a battery case;
and

sealing the battery case with said electrode caps.